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Hormones New and Old*

BY

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THIS account does not attempt to review the whole subject indicated by the title. No discussion will be offered of the relatively newly discovered hormones such as glucagon, tri-iodothyronine or relaxin, nor of the interesting substances extractable from tissue like 5-hydroxytryptamine and bradykinin which some authorities consider to be physiological local hormones. Instead, this paper will be restricted almost entirely to physiological and pharmacological aspects of steroid hormones, including as "new hormones," synthetic and semi-synthetic substances closely related in structure and action to naturally occurring endocrine secretions.

One of the most interesting developments of recent years has been an elaboration of our knowledge of the bio-chemistry of the steroid hormones which has led to the production of powerful therapeutic tools. It is convenient to consider the steroids separately as androgens, oestrogens, progestagens and adrenal cortex hormones, but before doing so emphasis must be given to the close overlap in action. The specificity of action of any steroid compound appears to be a function of small details in chemical configuration. It is not surprising that some new compounds, which differ from natural steroids in only small changes of chemical structure, do have multiple actions and cannot be classified solely into one of the 4 groups mentioned. Most of the new androgens have some progesterone-like activity, and amongst the new progestagens there are several with an oestrogenic component to their action and others with an androgenic component. Even the natural hormones are not necessarily specific in their actions—progesterone has androgenic activity and the effect of deoxycorticosterone extends beyond the control of electrolyte balance. In fact, some of the compounds recently developed are of importance because they are more specific in action than the natural substances from which they are derived.

The inter-relationship of the natural hormones has been illuminated in the biochemical sense by the demonstration of the key position of progesterone in the natural synthesis of the adrenal and gonadal steroids from acetate through cholesterol. Thus, testosterone and the oestrogens are formed from androstenedione which is itself formed from progesterone. Similarly the adrenal steroids are formed either directly from progesterone or from progesterone derivatives such as androstenedione (Samuels, 1955). This view of a common path blurs the concept of clear-cut distinctions in the actions of the several hormones.

Adrenal Cortex Hormones

The adrenal cortex is considered to secrete 3 types of steroid hormone—gluco-corticoids, minero-corticoids and sex hormones. The adrenal sex hormones will not be discussed here since their structure and action are similar to the sex hormones of gonadal origin, but it is worth pointing out that adrenal sex hormones are not unimportant—as for instance in the castrated animal where they are essential for the maintenance of bone structure ; they are also possibly involved in the maintenance of normal pregnancy, at least in the cow (see below).

Minerocorticoids

Of the minerocorticoids, deoxycorticosterone is the best known, but a few years ago it was shown that aldosterone is the most potent natural secretion of the adrenal cortex. It is 25 to 50 times more potent than deoxycorticosterone and is known to be liberated in the physiological response to sodium depletion. It facilitates the retention of sodium in the body, by its action on kidney tubules and on sodium-secreting organs such as the salivary glands. Coincidentally it facilitates the excretion of potassium. Over long periods aldosterone may produce negative calcium, phosphorus and nitrogen balance ; it is almost free of glucocorticoid action in contrast to deoxycorticosterone which has appreciable activity in this sense.

The minerocorticoids are not yet used in domesti-

* A Peter Wilson Bequest Lecture delivered at the Royal (Dick) School of Veterinary Studies, University of Edinburgh, on May 25th, 1960.

cated animals, except on an experimental basis, although they are coming into wide use in man, but it is worth referring to the very elegant experiments of Denton, Goding and Wright (1959) who used merino sheep to study the functioning of the adrenal gland when transplanted to the neck in such a manner as to provide access to arterial supply and venous drainage. Their beautiful experiments demonstrate that the output of aldosterone is not a function of adrenocorticotrophic secretion by the pituitary gland (as is the case with glucocorticoids) but is controlled, at least in part, by the sodium and the potassium concentrations in the arterial blood reaching the adrenal glands.

Glucocorticoids

The adrenal glucocorticoids have some minerocorticoid action. Hydrocortisone (Cortisol) has only one-thousandth of the potency of aldosterone on electrolyte balance but other glucocorticoids have greater relative activity and this can even be a toxic feature in over-administration of *gluco*corticoids, when the animal may show retention of sodium and depletion of potassium leading to oedema, muscle weakness and circulatory upsets.

The main actions of glucocorticoids are now well known to veterinary surgeons. Hydrocortisone is probably the most important glucocorticoid secreted by the gland under physiological conditions. It is usually more potent than cortisone when both are given locally although there is little difference when given systemically, presumably due to conversion of cortisone to hydrocortisone. The natural mechanism for increasing glucocorticoid secretion by the adrenals is the release of adrenocorticotrophic hormone from the anterior pituitary gland in response to stimuli usually referred to as " stress " but which include physiological states such as physical effort, pregnancy and lactation. The output of glucocorticoids is known to increase greatly after trauma. Maintenance studies in adrenalectomised men and women have shown an increase up to 10-fold in the daily hormone requirements of such patients immediately after undergoing fairly simple operations and manipulations.

A so-called " feed-back " mechanism exists whereby the secretion of ACTH is inversely proportional to the concentration of hydrocortisone in the blood. Thus the response of the adrenal cortex to ACTH is self-limiting in that the hydrocortisone secreted by the adrenal will inhibit the further secretion of ACTH. This has been found to have important clinical consequences. The administration of exogenous hydrocortisone, in systemic doses adequate to produce a therapeutic effect, for instance in arthritis, will inhibit the production of ACTH by the anterior pituitary gland. This will rapidly lead to atrophy of the patient's own adrenals, so that the patient becomes dependent on the exogenous supply of hormone. Cessation of treatment may lead to general adrenal deficiency which is clinically obvious if withdrawal is abrupt, but which may be sub-clinical with more gradual cessation. The latter condition is only revealed when the patient, after initial recovery, collapses into profound adrenal insufficiency when subjected to some subsequent stress such as that represented, for instance, by straightforward general anaesthesia. Six weeks' treatment with hydrocortisone has been associated in man with diminished adrenal cortex activity for a year afterwards (Cates, 1960). In animals, excessive treatment with glucocorticoids could be associated not only with decreased resistance to subsequent minor surgical or other insult, but also with decreased performance and decreased adaptation to the " normal " stresses met by racing and working animals.

The most extensive use of glucocorticoids in veterinary practice is undoubtedly as an anti-inflammatory agent. Hydrocortisone and cortisone suppress the increased vascularity, the increased capillary permeability, the swelling, oedema and the pain of inflammation. As a consequence they also decrease self-inflicted injury. They are active in all types of inflammatory reactions including allergic-type reactions showing pruritis and oedema, and they have proved life-saving in allergic oedema of the respiratory tract. They have been used extensively in animals for the treatment of eczemas, chronic dermatoses and pruritis of unknown origin, in photosensitisation and laminitis.

These agents suppress cellular reactions. Following administration there is a regression of lympoid tissue and a decrease in the numbers of some circulating white cells, notably eosinophils. The possible use of glucocorticoids in lymphatic leucaemia and oesinophilic myositis is the subject of discussion in THE VETERINARY RECORD (Joshua, 1960 ; Owen, 1960). Suppression of connective tissue proliferation also occurs with glucocorticoids and this is exploited in the local treatment of diseased eyes, to combat the formation of adhesions between internal structures of the eye, or to keep scar formation of the transparent portion of the eye to a minimum. Great care must be exercised, however, since the cellular inhibiting effect may facilitate corneal ulceration. Glucocorticoids are also used in the control of fibrous reactions of infected ears and in minimising the consolidation associated with agalactia and mastitis (Uvarov, 1959 ; Noble, Marshall & Oakley, 1960). In all such cases treatment should be local and should use hydrocortisone *together with an antibiotic.*

In arthritis, bursitis, tendosynovitis and associated diseases, hydrocortisone provides remarkable temporary relief of symptoms. When given locally into a joint it is rapidly taken up by the synovial membrane where it suppresses oedema and cellular infiltration ; the viscosity of the synovial fluid is apparently increased. The fundamental arthritic lesion is not repaired, however.

In all conditions when glucocorticoids are given to control inflammatory processes, either locally or systemically, it must be appreciated that they decrease resistance to bacterial invasion, and suppress the symptoms that would otherwise reflect the severity of the pathological state. The animal may appear better whilst it is rapidly deteriorating. It is essential, therefore, that hydrocortisone and its analogues be accompanied routinely, with adequate chemotherapeutic treatment.

Ketosis

The over-all effect of the glucorticoids in modifying general metabolism is well known and is recommended by some authors for the treatment of ketosis. These substances increase blood glucose concentration and the synthesis of liver glycogen from non-carbohydrate sources (gluconeogenesis).

In bovine animals the active mammary gland requires large amounts of carbohydrate, as glucose, to maintain the secretion of milk. Since the ruminant does not absorb dietary carbohydrate as glucose, and since the amount of glucogenic fatty acid (propionate) is inadequate (Lindsay, 1959) it follows that the neogenesis of glucose, probably from protein, must be augmented. According to Shaw and his colleagues (Shaw, 1956) this is achieved in the normal animal by an increased secretion of adrenocorticotrophic hormone and hence of hydrocortisone. However, some cows, after the stresses of pregnancy and of parturition, cannot meet the further requirement of ACTH for lactation, and they pass to a deficiency state manifest as ketosis. This view is not universally accepted. Glucocorticoids do produce a response in bovine ketosis, but whether this is the correction of a physiological disturbance, as suggested by Shaw, or a cruder, pharmacological, effect is not clear. This confusion emphasises our ignorance of the fundamental action of these and other hormones, such as insulin, in the endocrine control of energy metabolism.

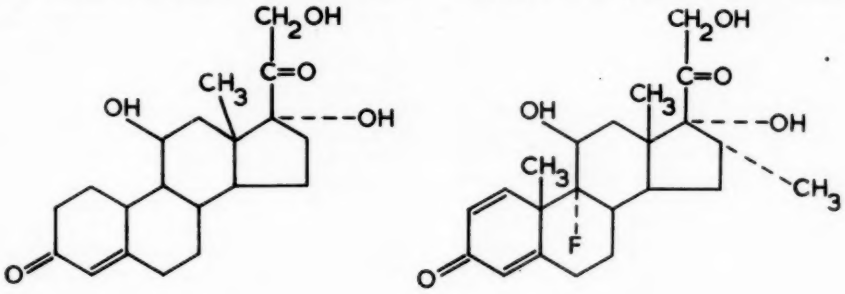
Recently Bach and Hibbett (1959, 1960), on the basis of their observation of an accumulation of pyruvate and of ketoglutarate in acetonaemia, have interpreted ketosis as a decreased efficiency of the citric acid cycle. This is initially due to inadequacy of the available concentrations of coenzyme A to meet the increase in metabolism, of carbohydrate within the cycle and of acetate outside the cycle, as lactation develops. This concept has the advantage of explaining the action of most of the established methods of treating bovine ketosis on the same basis—that of increasing supply of carbohydrate substrate to the citric acid cycle. The substrate push may come in at any of the successive stages of the cycle. This is in keeping with the observation that most forms of treatment (glycerol, glucose, hydrocortisone, propionate, etc.) have much the same degree of success (Animal Health Services Report, 1957). In this scheme hydrocortisone could be acting by increasing components for the cycle from aminoacids or other non-carbohydrate sources.

Pregnancy toxaemia of sheep according to Reid's group in Australia (Reid, 1960) is not due to a deficiency of adrenal glucocorticoids but to an excess. It is suggested that in multiple pregnancies the drain of maternal glucose and protein to the foetus is an almost pathological stress. This leads to high hydrocortisone concentration in the blood and any further environmental stress such as severe exposure, or deprivation of food, increases the hydrocortisone secretion so greatly as to produce symptoms due really to the antagonism of insulin by an excess of glucocorticoids—an adrenal-diabetes which, however, is obscured by the drain of maternal glucose to the foetus. There is factual evidence of increased circulating hydrocortisone in pregnancy toxaemia (Lindner, 1959) but whether this is cause or effect remains to be seen. Reid's hypothesis is, however, in keeping with general lack of success of treatment with glucocorticoids.

Synthetic Glucocorticoids

New compounds have been evolved with increased duration of action or increased potency. In particular glucocorticoids with very little effect on electrolyte balance have been made available.

Prednisolone, now well known in this country, has some 5 times the glucocorticoid activity of its homologue hydrocortisone, and is used in ketosis and in the control of inflammatory states. Methyl prednisolone has similar actions but is virtually free of sodium retaining effects. Fluorination increases the chemical stability and hence length of action. It also increases potency. Dexamethasone (see Fig. 1) and triamcinolone each have a fluorine atom at the carbon-9 position and represent compounds with increased glucocorticoid effects and decreased sodium retention. Dexamethasone has been reported effective in bovine ketosis in doses of only 10 mg. or less *by mouth* (Biller, 1960). The corresponding dose of prednisolone is 50 to 200 mg. given *by injection* (B. Vet. C., 1959). Dexamethasone has also been used effectively in animals with arthritis, summer eczema and various inflammations. It probably represents the most interesting of the new compounds and is worthy of greater study by veterinary clinicians in this country.



HYDROCORTISONE DEXAMETHASONE

FIG. 1.—A new synthetic corticoid, Dexamethasone, of higher potency and longer action is shown in comparison with hydrocortisone, the natural hormone.

Sex Hormones

Androgens

By definition the characteristic actions of androgens are seen in the normal adult male in which they control sexual structure, function and behaviour. Androgens are also secreted in females and these substances have some common physiological actions in both sexes, concerning the metabolism of protein and of electrolytes and also in promoting libido.

Lindner (1960) has directly measured the output of androgens in the spermatic-cord venous blood of the stallion, the boar and the bull. His figures indicate total daily testicular secretion of only 5 to 20 mg. for these species ; this suggests that the currently recommended doses of testosterone preparations (up to 300 mg. as injection of testosterone propionate—B. Vet. C., 1953) are excessive. Dosage is of importance. In the first place testosterone is expensive. Secondly, in the treatment of declining performance of stud males (where attributable to deficiency of male hormones) it must be remembered that one action of exogenous testosterone will be to inhibit the anterior pituitary gland and decrease the output of the trophic hormones responsible for maintaining gonadal function. Precise dosage merits greater attention than has been customary.

Many new androgens of importance in human medicine have been developed. Some are more potent, are longer lasting than testosterone, and have oral stability. Included in those with long duration of action are fluorinated compounds. These should be distinguished from certain very long-lasting esters of testosterone and methyl testosterone recently developed. In these esterfication is with unusual fatty acids (phenyl-propionic, cyclopentyl-propionic, cyclohexyl-propionic, decanoic and oenanthic acids). These esters have effect for up to 6 weeks after a single injection and represent a compromise between injection of simple propionate and implants of crystalline testosterone.

Of greater interest, however, is the development of compounds in which the virilising and the anabolic components of androgenic activity have been partially separated. Large numbers of homologues of testosterone have been prepared systematically (Zaffaroni, 1960b). In particular those without a methyl group at position 19 (the 19-nor-testosterones) have greatly decreased masculinising action in females and castrates but retain full, or even increased, anabolic potency, as revealed by nitrogen retention, protein synthesis, and muscle growth, when compared with testosterone. Moreover many are stable by mouth. These compounds have a greater calcium-sparing action than testosterone and improve the growth and development of bone especially by augmenting the development of the protein matrix of bone tissue upon which mineralisation is dependent. The rate of healing of fractures in castrated animals is restored to that seen in normal animals. Nor-ethandrolone (see Fig. 2) and other nor-testosterones have been used in human medicine to potentiate the rate of healing of fractures in aged and post-menopausal patients and to antagonise osteoporosis of endocrine origin, such as that seen during prolonged corticoid therapy. The effect upon protein synthesis has been shown by direct experiment in animals to increase the tensile strength of healing wounds, to reverse the usual negative nitrogen balance after operations and trauma, and to antagonise the atrophy of the muscles of immobilised or paralysed limbs. These substances have possible applications in domesticated animals along these lines. Their use is mainly indicated in old and debilitated patients, and if ever used in growing animals there is some risk of causing premature closure of the epiphyses of long bones.

Oestrogens

Oestrogens are well known to affect not only the female reproductive organs (ovary, tubes, myometrium, endometrium, cervix, vagina, mammary gland and pituitary gland) but also secondary sexual characteristics including the deposition of body fat, of bone minerals and of the elastic tissue of skin. They are by definition also concerned with female courtship behaviour.

In discussing the use of oestrogens it is valuable to distinguish between "physiological" effects and "pharmacological" effects. The former would include attempts to restore normality as in the treatment of ovariectomised bitches or in promoting mating behaviour in females with anoestrous ovulation (silent heat). The "pharmacological" effects are usually associated with unphysiologically large doses and include the deliberate inhibition of the anterior pituitary gland ; the post-coital "contraceptive" effect exploited in treating misalliance of bitches ; and the effects in male animals.

The dosage of oestrogens required to imitate normal secretion (physiological dosage) now appears to be low. The dose required in the ovariectomised bovine animal to restore cervical secretion to normal (Glower, 1960) indicates that oestrus effects are obtainable with only 0·1 to 0·8 mg. hexoestrol per day. In the ewe, Robinson, Moore and Binet (1956) have shown that 20 μg. oestradiol is effective in producing both behavioural oestrus and vaginal oestrus. A general dose rate of 1 μg. per kilo for the potent oestrogens appears more reasonable than those more conventionally recommended. As with the other steroid hormones which have a feed-back effect on the anterior pituitary gland, doses greater than the physiological minimum may have a general after-depression on reproductive function.

For producing frankly pharmacological effects much larger doses are used, in some cases deliberately producing anterior pituitary inhibition as when stilboestrol is given to suppress unwanted lactation. Probably the largest doses are those recommended for producing abortion in cows (Hill & Pierson, 1958) when the effects of endogenous progesterone must be antagonised.

In males oestrogens are used specifically in the treatment of hyperplasia of prostate and of anal glands. A more important application, however, is the caponisation of cockerels and the stimulation of the growth of ruminants. Present evidence indicates that the effects in the bird differ from those in the ruminant. Thus in the fowl oestrogens produce a lipaemia (possibly in relation to natural egg-yoke production) and this in the male results in wide-

spread deposition of fat throughout the body. In ruminants, however, oestrogens produce an increase in body protein and bone rather than fat. Steers so treated grow some 25 per cent. faster over short periods and the food conversion ratio is 15 per cent to 20 per cent. better than in untreated animals.

The oestrogens used are the cheap synthetic agents. Since these compounds are reasonably stable the possibility has been voiced that small amounts sufficient to affect people consuming the meat might persist in the edible flesh. This has resulted in some loss of confidence by the public purchasing the meat of oestrogen-treated animals, particularly in the United States. This possibility has recently been investigated in this country by studying the fate in ruminants of small doses (1 μg. per kg.) of tritium labelled hexoestrol (Glascock & Hockstra, 1958, 1959). The results to date indicate that absorption and distribution of oestrogen is rapid even when given as an oil soluble ester, and that 80 per cent. is excreted within 8 hours, 98 per cent. within 24 hours. Less than 2 parts per 1,000,000,000 persist in the flesh indicating that something like a ton of meat would be required to provide one human dose of the oestrogen.

These experiments with labelled hexoestrol are interesting in another aspect in that they show that oestrogens are distributed in the body in a selective manner with the highest concentrations in the organs of the reproductive tract (and kidneys). Significantly, the concentration measured in the pituitary gland was 9 times that in indifferent brain tissue !

New Oestrogens

The newest oestrogens have considerable advantages in human medicine but not for use in animals. Ethinyl oestrodiol is now widely used in man in whom it has a potency 20 times that of oestradiol itself. This, however, refers to oral administration. When given by injection it is of the same order of potency as oestradiol. It has fewer side actions than existing orally stable compounds (stilboestrol and hexoestrol) but this advantage is unlikely to weigh sufficiently in its favour in veterinary practice to offset its higher cost.

As with androgens, new long-acting esters have been developed and 2 other new compounds, chlorotrianisene and methalloestril, are available which have the property of very prolonged action due to their being stored in fat and released slowly. These may have some indications in domesticated animals—as in the treatment of castrated bitches, in endocrine osteoporosis or in certain neoplasms of males—but they are not advantageous where rapid brief action is required, for induction of oestrus or in misalliance. Their relative concentration in fat would be a disadvantage for administration to meat-producing animals.

Progesterone and Progestagens

A very considerable interest has developed in the actions of progesterone and its analogues. One possible physiological action—the maintenance of pregnancy—is discussed below. Another, and in some ways more exciting interest, is their pharmacological action as antifertility compounds.

Antifertility Compound

No apology is offered for presenting agents decreasing fertility to a veterinary audience. We are all too aware of the widening gap between the world's population and its food supplies and it is common knowledge that for some years laboratory scientists have been searching for a simple pharmacological agent with which to control human reproduction. This subject has recently been reviewed by Jackson (1960) who has indicated that although it is possible to control mammalian reproduction pharmacologically, at the stages of fertilisation, tubal transport, nidation, and spermatogenesis, none of these methods are suitable for widespread application in man. However, considerable success can be achieved by suppressing follicular growth, and this appears to be reasonably acceptable to at least some human societies.

Progesterone analogues are used for this purpose. (This should not be surprising since progesterone itself normally suppresses follicular growth and maturation during pregnancy.) Exogenous progesterone, however, to be effective, must be given by injection which limits its usefulness. Substitution at the 17 position and demethylation at position 19, confer oral stability increase potency and prolong duration of action. These compounds—of which there are a large number, are similar to androgens in structure and many of the new androgens have progesterone-like activity (see Fig. 2). The new progestagens such as nor-ethisterone and nor-ethynodrel, are potent antifertility agents in rats, rabbits, sheep and man. The concentration of F.S.H. in the anterior pituitary gland is decreased. They produce 100 per cent. sterility in rats when given daily over several months, yet after a treatment-free period of less than one month, reproduction reverts to normal in the same rats. In man they have been tried in several well-conducted investigations. With one compound 100 per cent. success is reported in 1,000 women over several years representing some 25,000 potential ovulations (Zaffaroni, 1960a). Another large investigation (16,000 " cycles ") reports a conception rate of only $2\frac{1}{2}$ per 100 woman-years—*i.e.* on average one pregnancy per person per 40 years, with excellent reversion to normal function on cessation of administration (Pincus, 1960). Side actions are reported to be slight and in general are similar to the side actions of pregnancy itself. The female becomes " pseudo-pregnant " for as long as the pills are being taken. At present these substances are expensive, but since they can be made from natural plant steroids, readily extractable from abundant sources, they will inevitably become cheaper.

For certain uses in domesticated animals these compounds may well be preferable to progesterone. They could be used for the abolition of oestrus periods not only in pets but also in exhibition, racing and working animals. It is noteworthy that recent trials in the bitch indicated that oral administration completely suppressed oestrus and that after cessation of treatment, oestrus did not re-appear until the next expected date (Zaffaroni, 1960a). Thus it seems that intermittent administration is all that is necessary for

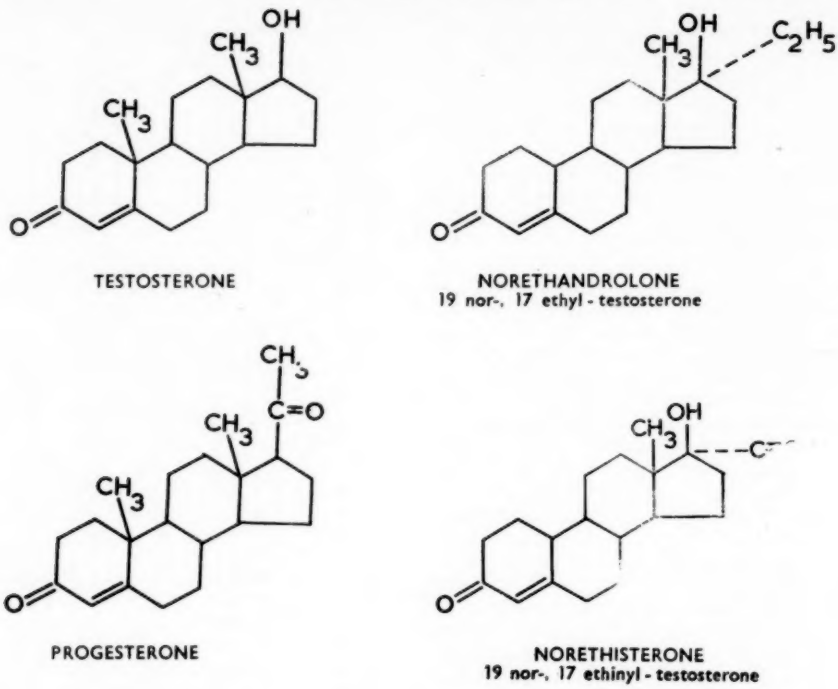


FIG. 2.—Testosterone is shown in relation to a new " nonvirilising " androgen, Norethandrolone. Progesterone is shown in comparison with a new highly potent progestagen, Ethisterone, which is effective as an antifertility compound.

The synthetic androgen and synthetic progestagen are very similar in structure and there is some overlap in actions.

animals with discontinuous or seasonal breeding rhythms.

By virtue of their greater potency these progestagens may also be useful in the treatment of cystic ovarian disease and may replace progesterone for use in conjunction with F.S.H. in the production of coincident oestrus in groups of sheep, heifers or sows (Gordon, 1958). They are, however, unlikely to show any advantage over implants of progesterone or repeated injections of the highly potent derivative now available 6-methyl 17-hydroxy progesterone, for treatments of long duration such as the maintenance of pregnancy or of lactation.

Progesterone and the Maintenance of Pregnancy

Interest in the importance of progesterone in the physiology of pregnancy and parturition has revived. The established view has been that this substance is secreted in early pregnancy by the corpus luteum, and later by the placenta (with some variation between species), and that it maintains pregnancy by depressing myometrial reactivity to oestrogens and to oxytocin. This interpretation, although largely based upon observations in laboratory animals, especially the rabbit, has led to the trial of progesterone therapy in habitual abortion both in women and in domesticated animals.

However, it has been demonstrated that uterine reactivity actually increases throughout pregnancy in man despite the coincident rise of progesterone concentration in the blood. Furthermore, numerous authors have reported disappointing results in women when progesterone is injected or implanted in attempts to prevent abortion or to delay birth.

Reports concerning progesterone therapy in domesticated animals are fewer ; the results and their interpretation are very variable, as emphasised by recent correspondence in THE VETERINARY RECORD (Nov., 1959). In the last few years methods have been developed by Zander and others (see Zander & Simmer, 1954) for the chemical estimation of progesterone in blood and tissues. One productive British contributor to this field has been R. V. Short, a veterinary scientist, who has extended observations to domesticated animals and to whose work frequent reference has been made in compiling the notes which follow (for review see Short, 1960b).

Injected progesterone has a very short life in the circulating blood, and from a knowledge of plasma concentration, plasma volume and the half life of progesterone it is possible to calculate the daily turnover of progesterone in milligrammes. In women the concentration of progesterone in peripheral blood is relatively high (20 microgrammes or more per 100 ml. plasma at term) much higher than that in the mare, cow, ewe, sow or bitch. In pregnant women some

250 milligrammes per day are estimated to be required to maintain blood concentration (Pearlman, 1957). This is a large amount to supply therapeutically either as implant or daily injections. In the domesticated animals, however, plasma concentration is much lower and if the half life of progesterone is similar to that in women, as seems to be the case, then the daily turnover will be proportionally less.

In the mare it seems that progesterone is only detectable in the peripheral blood for the first 10 weeks or so of pregnancy and in low concentration (less than 2 μg. per 100 ml.) ; progesterone implants might be adequate to maintain the minimum daily turnover in early pregnancy in this species. However, after 15 weeks of pregnancy in the mare no progesterone is detectable in the peripheral blood, although it is readily demonstrable in the placenta and in umbilical blood (Short, 1959). It is possible that intra-uterine production of progesterone suppresses myometrial reactivity by virtue of a high local concentration. If this is so, it could not easily be imitated by systemic administration of exogenous progesterone. Such considerations have been evoked to explain the ineffective results of generous progesterone therapy in women.

In the cow progesterone has not been detected in the placenta, foetal blood or uterine venous blood, although it can be extracted from peripheral blood during pregnancy in small amounts (corresponding to the daily production of some 35 mg.) (Short, 1960a). This distribution suggests that placental production is less important in the cow than other species. The daily production could feasibly be met in normal pregnancy from extra-uterine sources such as the adrenal glands and the corpora lutea. In such a system exogenous progesterone therapy in the form of implants or injections would appear to have greater prospect of success in maintaining threatened pregnancies than in the mare or in women.

Parturition and Progesterone

Parturition, it has been suggested, is fundamentally initiated by the withdrawal of progesterone block (Csapo, 1956). This concept is based almost entirely on work in the rabbit, in which species progesterone is known to prolong pregnancy, and to depress the contractility of the uterine muscle and its reactivity to oxytocin. In the rabbit, according to Bengtsson (1957) and Schofield (1957), the character of the response of uterine muscle to electrical stimulation is typical of progesterone dominance throughout pregnancy, but about 24 hours before parturition it changes to assume the character of an oestrogen-dominated myometrium.

However, no increase in sensitivity at the very end of pregnancy is seen with the human myometrium (Caldeyro-Barcia & Sereno, 1959), as would be expected if oestrogen domination occurred at this time. Contrary to the report of Knaus (1934) progesterone does not depress reactivity of uterine muscle, is not effective in threatened abortion, does not prolong pregnancy and has no effect on the character or duration of labour. Even in high doses (100 mg.) intravenously it has no effect on the type or frequency of contractions, nor do repeated high doses (200 mg. intramuscularly every 12 hours) have any effect on duration of labour, on the uterine work required for cervical dilatation, or on the sensitivity to oxytocin (Fielitz & Posé, 1960). Furthermore, the high progesterone concentration in maternal blood does not fall before parturition but only after separation of the placenta (Short & Eton, 1959 ; Zander, 1960). Progesterone is still detectable in umbilical blood taken at the moment of birth (Aitken *et al.*, 1958). In view of the known short half life of progesterone this indicates that progesterone is still being secreted during labour.

In domesticated animals corresponding observations of maternal blood progesterone concentrations being maintained right to the very end of pregnancy have been recorded for the ewe (Short & Moore, 1959) and the presence of high concentrations of progesterone in umbilical blood at birth has been recorded for the foal (Short, 1959) indicating that continuing secretion of progesterone during labour is not confined to the human subject.

Only in the cow is there any indication of a decrease in progesterone secretion before labour. Short (1958) has reported a decline in progesterone concentration of maternal blood recognisable some 2 weeks before birth. This interval, however, appears too long to implicate withdrawal of progesterone block as the sole cause of the initiation of parturition. Such evidence as is available indicates that at the end of pregnancy in the cow there is an increase in uterine sensitivity to oxytocin, but that this occurs within the last 48 hours before birth (Fitzpatrick, 1960), rather than 2 weeks earlier, as would be expected if this were a consequence of progesterone withdrawal. Thus even in the cow it would seem that progesterone withdrawal cannot be more than a contributing factor in the control of parturition.

Oxytocin and Parturition

We have for some time been interested in the relation of oxytocin to parturition. Another hypothesis, alternative or additive to the removal of a progesterone block, is that there occurs an increased secretion of oxytocin during labour. Ever since the oxytocic activity of posterior pituitary extract was discovered 50 years ago it has been tempting to suggest that this gland influences parturition. There has been no direct proof of this, however, although a physiological mechanism in which pressure dilating the cervix releases oxytocin from the posterior pituitary was described some years ago in the rabbit (Ferguson, 1941).

For some years the author has been using a simple acetone method for the extraction and estimation of endogenous oxytocin in blood plasma. This method, together with specific biological and chemical tests of identification, has been effective in detecting increased amounts of oxytocin in jugular blood during stimulation of the pituitary stalk in rabbits, and during the milk let-down reflex in ewes. The same procedures detected greatly increased oxytocic activity of jugular blood of ewes in the terminal stages of labour. This activity disappeared rapidly after labour was completed. The active substance was tentatively identified with oxytocin using selective antagonists of interfering

substances, chromatography, stability to sodium thioglycollate and parallel assays using rat uterus, guinea-pig ileum and a recently described sensitive rabbit mammary gland test (Fitzpatrick, 1959). The maximum concentrations found were 1 to 3 mU per ml. at the very moment of delivery. The same technique indicated a concentration of up to 200 μU per ml. in the peripheral blood of a woman at the moment of delivery of the head of the infant. Similar concentrations of up to 200 μU per ml. in the peripheral blood have since been found, using different technical procedures in a group of 20 women in labour (Cabot, Caldeyro-Barcia, Fitzpatrick & Mendez-Bauer, 1960). Control blood samples from the same women *post-partum* only had activity of the same low order (<25 μU per ml.) as in non-pregnant women and in men.

These observations support the use of synthetic oxytocin in clinical obstetrics. Unfortunately, very little attempt has been made in veterinary obstetrics to use this substance. This is partly the legacy of a somewhat heroic approach to obstetrics in farm animals, and is partly due to lack of information on the delicate use of what can be an extremely dangerous drug. But now that synthetic oxytocin is available, the continued use of the crude preparation, pituitrin, cannot be justified. Pituitrin contains vasopressin (in unidentified amounts) which not only can act dangerously on the kidneys and cardio-vascular system, but which also interferes very seriously with the response of the uterus to oxytocin, so that precise dosage in terms of the latter component of the mixture becomes meaningless.

That oxytocin, in its purified form should be used by veterinary surgeons in much smaller doses than those hitherto recommended, has been previously discussed (Fitzpatrick, 1957 and 1960). Doses widely employed to-day do, in fact, represent overdosage which not only threatens the life of the foetus (or even the mother) but also produces a contracture of the uterine muscle (Jung, 1959) seen clinically as an *interference* with the progress of parturition.

The elegance with which oxytocin could be used can be gauged from the now widespread use of oxytocin drips in human obstetrics, for the elective induction of labour, for uterine inertia and for other conditions. Doses of the order of only 2 to 4 milliunits per minute, corresponding to not more than ¼ of a unit per hour are reported wonderfully effective by clinicians (Theobald *et al.*, 1948, 1956, and others) and have been amply supported by physiological evidence that uterine activity with these doses of oxytocin matches that of natural labour (Caldeyro-Barcia & Poseiro, 1959). There can be no doubt that the future developments of veterinary obstetrics should include similar work, but the precise use of pharmacological agents like oxytocin needs to be based on a far better understanding of the stages of parturition in domesticated animals than our present ignorance permits. The need for a research unit of veterinary physiological obstetrics is real.

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INDEX TO "THE VETERINARY RECORD"

The index for 1960 is in an advanced stage of preparation, and will be circulated in the next few weeks, so that members who are waiting to have their volumes bound will be able to do so.

Newcastle Disease in the Jackdaw *(Corvus monedula)*

BY

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SUMMARY.—1. *The natural infection of a wild jackdaw* (Corvus monedula) *with Newcastle disease, associated with an outbreak of the infection in poultry, is described.*

2. *Circumstantial evidence suggested that jackdaws may have played a part in the spread of the disease.*

3. *Jackdaws which were fed infected embryonated fowls' eggs, produced a significant, but short lasting antibody response, although unlike the wild bird, they showed no clinical signs of the disease and virus was not recovered from the internal organs.*

WILD birds have frequently been suspected of spreading Newcastle disease mechanically and several British species are reported to be susceptible to the disease (Keymer, 1958), although only a few cases of natural infection based on isolation of the virus have been recorded.

At this laboratory many attempts have been made to isolate Newcastle disease virus from wild birds and free-flying domestic pigeons. Between November 1st, 1957, and June 30th, 1960, virus isolation was attempted from the carcases of 94 wild birds and pigeons representing 11 different species. Thirty-five of these birds were found either ailing or dead, on or near premises where the infection was present or had recently been present, in domestic poultry. They consisted of 9 house sparrows (*Passer domesticus*), 7 pheasants (*Phasianus colchicus*) 7 wood pigeons (*Columba palumbus*), 3 domestic pigeons (*C. livia*), 3 rooks (*Corvus frugilegus*), 3 jackdaws, a carrion crow (*Corvus coronae*), an immature starling (*Sturnus vulgaris*) and a blackbird (*Turdus merula*). Newcastle disease virus was isolated from the internal organs of only 2 of these birds, namely a jackdaw and a house sparrow.

The virus has been isolated previously from a house sparrow (Gustafson & Moses, 1953), but there appear to be no records of the disease in a jackdaw, and it is for this reason that an apparent natural infection in this species, associated with an outbreak of the disease in poultry, is recorded, together with the subsequent experimental infection of jackdaws.

History of the Outbreak and Description of the Disease in Poultry

On April 13th, 1958, Newcastle disease was suspected and reported in a flock of domestic fowls kept semi-intensively in range houses on a general farm in Essex. The presence of Newcastle disease was confirmed the following day by the results of the haemagglutination inhibition (H.I.) test. Other poultry, however, which were housed intensively in a deep litter house remained healthy, until compulsorily slaughtered under the Fowl Pest Order. There had been several outbreaks of the disease in the county and the nearest, confirmed the day before, was only 5 miles away.

The disease was of an acute nature; egg production had fallen sharply within 4 to 6 days and about 30 deaths occurred in a group of 325 pullets and hens, whilst 30 others were obviously sick, some showing nervous symptoms. Fourteen blood samples were subjected to the H.I. test; 7 being positive, 3 doubtful and the remainder negative.

Autopsy of fowls which had died revealed petechiation on the gizzard fat and coronary groove of the heart. Tracheitis was also evident and in one bird blood clots were present in the trachea.

The clinical signs shown by the infected poultry closely resembled those seen in other recent outbreaks in the county, all of which had been traced to a poultry packing station. Exhaustive enquiries, however, failed to link this outbreak with the others in the district and the farmer suspected that 5 or 6 jackdaws, which had frequently been seen feeding with his poultry since the previous autumn, were responsible. About a fortnight before the disease was confirmed in the fowls, some of the jackdaws appeared mopey and had ruffled feathers. During this period, the birds, instead of making fairly brief daily visits to the farm were noticed to be present nearly all the time, presumably taking advantage of the readily available source of food when they were too weak to forage in the normal way. The farmer shot 2 of the obviously sick birds and burnt them. Seven to 10 days prior to the disease being confirmed, the fowls had actually been seen to attack an ailing jackdaw and kill it. Unfortunately this bird was not available for examination, but on April 14th another ailing jackdaw was killed and submitted for autopsy. It was found to be in very poor condition and heavily infested with lice and mites, although these were not species found on domestic poultry. Extensive lesions of tuberculosis were present involving many of the internal organs, the disease being confirmed by cultural methods. Transmission experiments using susceptible fowls and inoculation of embryonated eggs failed, however, to reveal the presence of Newcastle disease virus in the internal organs of this bird.

On April 23rd another jackdaw was examined which had been killed near the poultry houses, being unable to fly, and it was from this specimen that Newcastle disease virus was isolated, both from various internal organs and also from the feet and feathers. No lesions of tuberculosis were present, and cultures did not yield *Mycobacterium avium*.

After this date no further sick jackdaws were seen, although when the author visited the farm on May 14th he was informed that, a week before, a dead jackdaw which did not appear to have been shot or

injured was found in a field about a mile away. Enquiries in the district failed to produce any other evidence of mortality in any species of wild bird and it was noticed that there were at least 2 thriving communities of jackdaws within a mile of the infected farm, one being close to a rookery. The rooks and jackdaws mixed freely and foraged in the surrounding fields and farms. It was decided therefore to examine a number of rooks which had recently been shot by a farmer and also nesting material, eggs and a fledgling from the nearby jackdaw colony. On *post-mortem* examination of 8 immature rooks, no lesions were found and egg inoculations failed to reveal the presence of Newcastle disease virus, in various internal organs from 2 of the birds. Similarly the virus was not isolated from their feathers and feet nor from the fledgling jackdaw, jackdaw eggs or nesting material.

On May 17th, 2 house sparrows were found dead in a garden in the same village as the infected farm and the following day 3 more died. On examination of 2 of these birds the cause of death could not be found and attempts to isolate Newcastle disease virus from both the plumage and the internal organs were unsuccessful.

Post-mortem Lesions of the Infected Jackdaw

At autopsy the bird showed marked wasting of the pectoral muscles and was heavily infested with lice and mites of the same species as those infesting the other jackdaw.

The only significant macroscopic lesions in the internal organs were oedema and patchy areas of congestion in the lungs, marked thickening and cloudiness of the air sacs, several large ecchymotic haemorrhages in the spleen and a few small discrete areas of necrosis and congestion in the liver. The spleen was rather enlarged, although the liver was normal in size.

Experimental Infection of Jackdaws

Wilson (1958) found jackdaws to be resistant to one million minimal lethal doses for the fowl, by injection, the birds even failing to produce a positive H.I. titre in their blood. It was decided therefore to attempt infection by the more natural method of feeding infected material.

(a) *Method of Infection*

Some wild adult jackdaws were obtained and kept for several months until they had become accustomed to life in captivity, and eventually 6 were used for the experiment. Embryonated fowls' eggs at the ninth day of incubation were inoculated into the allantoic cavity using the virus which had been isolated from the naturally infected jackdaw. After the death of the embryos and confirmation of Newcastle disease infection, 1 embryonated egg each was fed to 2 of the jackdaws (Group A). Two other birds were similarly fed infected eggs daily for 14 days (Group B), and 2 birds were used as controls, receiving non-infected eggs each day. Prior to commencing the experiment, blood samples taken from all of the birds gave negative results when subjected to the H.I. test.

(b) *Results*

Throughout the experiment all the birds appeared to be healthy and at no time showed clinical signs of disease. Commencing on the seventh day, each bird was bled periodically from a wing vein and the blood subjected to the H.I. test. A significant, although short lasting, antibody response was demonstrated in the birds which had been fed infected material, thus indicating that the species, although comparatively resistant, is susceptible to the infection.

It is interesting to note, that the highest titres attained in 3 of the birds (2 from Group A and 1 from Group B) were present at the first test, but by the time one bird from each group was killed, 37 days after first being exposed to the virus, antibodies had virtually disappeared. In fact, the titres had actually fallen below that usually regarded as positive, as early as the 23rd day. These results differ from those normally obtained in the domestic fowl, when antibodies frequently remain present in significant titres for several months.

One bird from each group was killed 17 days after the beginning of the experiment. This was 16 days after the bird in Group A, and 3 days after the bird in Group B was last fed an infected egg. The day following the last exposure to the virus, the living quarters of both birds were thoroughly cleansed and disinfected and the birds transferred to clean cages to ensure that virus was absent from the environment when infected eggs were no longer fed. Attempts to isolate the virus from the brain, respiratory system, liver and spleen, intestine and vent feathers of both birds were unsuccessful.

The above results closely resemble those obtained by Karstad, Spalatin and Hanson (1959), and Baczyński (1960). The former workers artificially infected, by the oral route, the American crow (*Corvus brachyrhynchos*) which is closely related to the jackdaw. They recorded high H.I. titres in blood samples from 3 crows when first examined after 14 days, but these birds also showed no clinical signs of disease and neither were these workers able to isolate the virus from various internal organs, 14 days after exposure. Twenty-four hours after the ingestion of the virus, however, it was present in the faeces of one of the birds.

Baczński fed infected food to jackdaws and examined their droppings daily for 5 days. He isolated the virus from the droppings 1 to 4 days after infection and when blood samples were subjected to the H.I. test between the seventh and eleventh days, high titres were obtained.

Discussion

Assuming that at least one of the sick jackdaws on the farm where the disease occurred in poultry was actively infected with Newcastle disease, as seems probable, it may be worthwhile to discuss the possible part played by these birds in the epidemiology of this outbreak.

The circumstantial evidence for the assumption that the jackdaws infected the poultry can be summarised as follows:—

1. The disease in the poultry closely resembled

that seen in other flocks in the district, but the source of infection could not be determined.

2. The nearest recently infected farm was 5 miles away. This was probably within the range that foraging jackdaws might travel during that time of the year. At that farm the fowls were kept in open runs and although it was situated in a built up area it was close to a recreation ground and some trees, making the neighbourhood a suitable habitat for the birds (Witherby *et al.*, 1943).

3. Apparently healthy jackdaws visited the farm regularly for short periods before sick birds (presumably the same jackdaws), were noticed. It was only when they became ill that they stayed permanently on the premises.

4. Sick jackdaws were seen feeding with the poultry approximately 7 to 8 days before the fowls showed clinical signs of disease. Seven to 10 days before the disease was confirmed, some fowls were seen to attack and kill a sick jackdaw.

5. Only the fowls kept extensively and exposed to wild birds became infected; those kept intensively, remained healthy up to the time of slaughter.

6. There was no history or evidence of illness or deaths occurring in other jackdaws or any species of wild birds in the district prior to the diagnosis of Newcastle disease in the poultry and therefore no reason to suspect that this small group of jackdaws was infected with some other infectious disease. There was also no reason to believe that the birds had been poisoned.

The evidence against the jackdaws having disseminated the disease is similarly listed:—

1. There is no proof that any of the jackdaws were infected with Newcastle disease prior to the infection being diagnosed in the poultry, because the jackdaw in which the disease was diagnosed was obtained 8 to 9 days after the disease was confirmed in the poultry and the virus was not isolated from the one other specimen which was examined. The infected jackdaw may have contracted the disease from the poultry on the farm where it was killed and therefore was not responsible for infecting the fowls.

2. The clinical signs shown by the sick jackdaws may have been due to some factor other than Newcastle disease, especially as the 2 specimens which were examined were in poor condition, indicating a chronic type of illness.

Unfortunately no blood samples were taken from the sick jackdaws and therefore it is not known if the bird from which the virus was isolated showed an antibody response. It is just possible therefore that this bird may have been a mechanical carrier and not actively infected, although probably capable of disseminating the virus.

Both jackdaws which were examined were heavily infested with ectoparasites, but there is no evidence that these were the primary cause of their poor condition and sickness, as in the author's experience, wild birds which are heavily infested with ectoparasites are usually affected with some other disease.

Although one jackdaw was infected with tuberculosis, it is unlikely that the others had this disease, because although tuberculosis is relatively common in wild birds (Keymer, 1958), there is no evidence that it appears in such a virulent or widespread form as to attack all the members of a small group or community of birds at the same time.

Conclusion

It has been shown that jackdaws can be artificially infected with Newcastle disease and circumstantial evidence, together with the various diagnostic findings suggest that the species can also become naturally infected. It was not possible, however, to reproduce the disease artificially, in the same form as it appeared to occur naturally; the artificially infected birds failing to show clinical signs or macroscopic lesions at autopsy, the only evidence that they were infected being an antibody response. It seems likely therefore that adult jackdaws are relatively resistant to the virus when exposed to it orally and intranasally by feeding contaminated food and that subclinically infected birds probably only excrete the virus in their droppings for a few days after becoming infected, as actually shown by Baczyński (1960).

The results of this investigation and those by other workers suggest that passerine birds, including members of the crow family, Corvidae (to which the jackdaw belongs), are not particularly susceptible to Newcastle disease and when exposed to the infection quickly become resistant. Nevertheless, circumstantial evidence appears to favour the opinion that more than one jackdaw became naturally infected in this outbreak and may have disseminated the disease resulting in the infection of domestic poultry.

As suggested by Brandly (1959) it seems likely that predisposing causes, *e.g.* "prior or concurrent devitalising factors" of some kind played a rôle in enhancing the severity of the disease, thus perhaps accounting for the difference between the nature of the infection in the wild and captive jackdaws in this investigation.

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(Concluded at foot of col. 1 overleaf)

Current Literature

REPORTS

Sierra Leone Veterinary Department : Report for the Year 1959.

The colony and protectorate of Sierra Leone, a country approximately the size of Scotland, has a cattle population of about 200,000 head. In his annual report for 1959 the Director of Veterinary Services, Mr. J. D. Birkett, M.R.C.V.S., points out that there are tremendous areas throughout the country, especially in the south-east and south-west, in which cattle could be successfully reared but which are not at present fully used because the local tribes have little interest in cattle. If this problem could be overcome the country's cattle population could probably be more than doubled, an achievement that would be of enormous value in view of the fact that at present thousands of trade cattle, with the attendant risk of introducing disease, have to be imported into Sierra Leone each year from neighbouring territories for slaughter.

During the year the Department's main activities were directed against contagious bovine pleuropneumonia. A recrudescence of the disease occurred in 1 district and necessitated an extensive vaccination campaign; over 50,000 inoculations, using a locally-made culture vaccine, were made. Co-operation from cattle owners was good and the success of the campaign did much towards improving the standing of the Department with them. Now that rinderpest no longer occurs contagious pleuropneumonia is the main cattle disease in the country.

Although rinderpest was again absent the Director warns of the constant threat that exists of its reintroduction from neighbouring countries through the relatively large numbers of trade cattle which enter Sierra Leone each year. Because of this risk the policy is to immunise as many of Sierra Leone's cattle against rinderpest as other commitments will allow. Unfortunately it is becoming increasingly difficult to carry out this policy with cattle owners who, because of the continued absence of the disease, have largely lost the fear that induces co-operation in vaccination campaigns.

Vaccinations were also carried out against blackquarter (24,360) and anthrax (6,030); neither disease, however, appears to be very common. Rabies, although not particularly widespread, was again present. Trypanosomiasis in pigs was less troublesome than in previous years.

Newcastle disease is responsible for the death of many thousands of fowls each year. As an efficient vaccine is offered by the Department much of this mortality could be avoided if only owners were more co-operative in vaccination programmes. During the year some 58,000 birds were vaccinated. Interest in commercial poultry keeping is said to be growing in the Freetown and Colony area.

A small laboratory is maintained at Teko where routine examinations are conducted and some vaccines produced. The year was notable in that electricity at last became available so closing, as the Director points out with obvious relief, "an era complicated by continual attempts to overcome the vagaries and vicissitudes of kerosene-operated apparatus."

Plans are evidently in hand to meet the Department's staff needs when the country eventually attains independence. Two Sierra Leoneans have already qualified as veterinary surgeons and a third is expected to do so soon. W. E. L.

Northern Rhodesia : Annual Report on the Department of Veterinary and Tsetse Control Services, 1959.

As a result of a rearrangement of Ministerial responsibilities the functions of the Veterinary Department change somewhat during the year. It took over tsetse control from the Game Department but relinquished animal husbandry, pasture research, cattle marketing, and the operation of the Mbesuma and Chishinga ranches, to the Agricultural Department. At the same time its headquarters were moved from Mazabuka to Lusaka; the Research Station and Veterinary School remained, however, at Mazabuka.

Northern Rhodesia is between 3 and 4 times the size of Great Britain and divided for administrative purposes into 6 provinces. Most of its livestock is owned by Africans; in the year under review they were reckoned to have 955,000 cattle, 135,000 sheep and goats, 50,000 pigs, and 900 donkeys. A further 170,000 cattle were in European ownership.

The Territory is still unable, however, to feed itself completely from its own stock, and during the year nearly 10,000 cattle and some 9,000 sheep, goats, and pigs, were imported for slaughter from Southern Rhodesia, Bechuanaland, and the Union of South Africa. A few cattle were also introduced for breeding. A useful fillip to the livestock industry has been the starting of the Cold Storage Commission in Northern Rhodesia; producers are now assured of a market at stable prices.

Apart from 82,000 hides and skins, and a growing trade in poultry to the Belgian Congo, exports were negligible.

Disease Control. Animal health was good. But as the Director, Mr. J. F. C. Swan, M.R.C.V.S., D.V.S.M., points out, this statement does not imply complacency, for although the major epizootics that interrupt trade were absent there were many other less dramatic but nonetheless troublesome diseases which necessitated much attention and effort. It is gratifying to note that this year the control

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Newcastle Disease in the Jackdaw.—*Concluded.*

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measures were, with few exceptions, generally welcomed, and indeed sought, a change from some of the blind opposition to the Department's activities the previous year.

The greatest hazard was again trypanosomiasis. This is a constant and enormous problem, the magnitude of which is reflected in the number (218,000) of trypanocidal remedies issued during the year, again a new record. There is no province without its fly problem. With the Department in charge of tsetse control there is now, however, a unified command of the forces against both fly and trypanosome; this administrative change may well be justified by the ultimate results.

Despite an enormously long tsetse front initiative against the fly was in general held. All the usual attack methods—selective bush clearing, game exclusion, insecticidal fogging and spraying, etc.—were used, depending on local circumstances.

In areas where cattle are exposed to intermittent fly attack drug prophylaxis is practised, but where they are virtually surrounded by fly and permanently exposed to infection the policy is to accept the risk and treat clinical cases as they arise. Despite hundreds of thousands of doses of trypanocidal drugs being used drug fastness in the field has not been recorded other than in 1 district.

Tick-borne diseases (anaplasmosis, rickettsiosis, and babesiosis) are ever present, and any relaxation or inefficiency in tick control is at once followed by outbreaks. Over one and a half million head of stock were dipped in African reserves. It is stated that the organic phosphorus dip washes, recently introduced, gave excellent control of all tick species. East Coast fever was confined to 1 district.

Contagious abortion is enzootic, and anthrax and quarter evil common enough to necessitate numerous vaccinations. Foot-and-mouth disease was fortunately absent, but streptothricosis is still common; no consistently reliable treatment for it has yet been found.

Tuberculosis was detected on several occasions. The African cattle owner does not take kindly to tuberculin testing and the compulsory slaughter of reactors; the whole problem is largely beyond his understanding, savouring of witchcraft, and he resents the compulsory loss of an apparently healthy animal.

Vibrio fetus in cattle was reported for the first time in the Territory.

Rabies occurred in all provinces and 81 cases were confirmed, a decrease on the previous year's total. Active opposition to vaccination has now virtually ceased—some 37,000 dogs were vaccinated during the year—and the main obstacle to large scale vaccination is merely apathy.

One dog with furious rabies survived for no less than 16 days after the onset of its clinical symptoms.

Vaccinations were also carried out against Newcastle disease, fowl typhoid, fowlpox, horse sickness, and calf paratyphoid.

The Department participated in the wild game rescue operations at Kariba, during which a tranquilliser (Largactil) was tried. It proved effective for the smaller animals, but not in larger antelopes or zebra where it appeared to cause excitement and toxic symptoms; it proved fatal to impala.

The latter part of the report deals in detail with the tsetse control measures adopted in each province. During the year 110 cases of human trypanosomiasis were recorded.

This interesting report is clear evidence of the full-time and worthwhile job Mr. Swan and his staff, which includes 21 veterinarians, have on their hands.

W. E. L.

AFRICAN HORSE SICKNESS

The following statement was made by Dr. M. Huq, Director of the Animal Husbandry Research Institute in Pakistan, at a recent emergency meeting on African horse sickness, convened in Paris, from January 17th to 20th, by the Food and Agriculture Organisation of the United Nations (FAO) in collaboration with the International Office of Epizootics.

"In 1960 the countries stretching from Turkey to India lost between two and three hundred thousand horses and mules from African horse sickness."

FAO has helped the countries infected to organise control of the disease, notably in arranging for supplies of vaccine from South Africa and in assisting such countries to set up their own vaccine production units in collaboration with the Onderstepoort Laboratory. The first laboratory was established in Teheran, and others quickly followed. Already the Middle Eastern and Asian countries have brought up their vaccine production to 200,000 doses a month—120,000 in Teheran, 50,000 in Cairo, 10,000 in Turkey and 20,000 in India. Pakistan, Afghanistan and Iraq will start vaccine production soon.

As it is not feasible to vaccinate all the thirteen million horses and mules in the infected areas, FAO will endeavour to organise mass vaccination immediately in those countries on the fringe of the infected zone, thus forming a "cordon sanitaire." This means that Turkey, Greece, Bulgaria, India and Eastern Pakistan will act as "buffers" against the disease to prevent further spread in Europe and the Far East. The U.S.S.R. has expressed its intention of developing vaccine production and of immunising, as may be necessary, equine populations in areas adjoining infected countries.

A.R.C. VETERINARY RESEARCH AWARDS

The Agricultural Research Council is offering 2 Veterinary Research Fellowships, tenable for up to 3 years, to provide opportunities for suitably qualified veterinarians to continue post-graduate research.

The Council is again offering post-graduate Research Studentships to holders of veterinary qualifications, and a small number of Veterinary Training Grants to enable honours graduates in one of the basic sciences to read for a veterinary qualification. Applications for these awards should reach the Council by March 15th, 1961.

Details are obtainable from the Secretary, Agricultural Research Council, Cunard Building, 15 Regent Street, London, S.W.1.

News and Comment

THE ECONOMICS OF VETERINARY PRACTICE

The Economics Committee of the Society of Practising Veterinary Surgeons completed, some little time ago, its task of surveying the economics of private practice, and the Society has just published its eagerly awaited book on this subject. Copies have been sent to members of the S.P.V.S. and are available to non-members within the professsion at a cost of 50s. Those who join the Society—the value of whose work for practitioners is illustrated by this new publication—may receive it, as members, on payment of a first annual subscription of £1. Applications for the book, or for membership, should be made to the hon. secretary, Mr. A. Steele-Bodger, 10, Bore Street, Lichfield, Staffs.

We hope in the near future to publish a full review of the work, together with editorial comment.

NEW B.V.A. HANDBOOK REVIEWED

Aspects of skin disease in the dog and cat

1961. BRITISH VETERINARY ASSOCIATION, 7 MANSFIELD STREET, LONDON, W.1. FREE TO MEMBERS OF THE B.V.A. ON APPLICATION.

There has been for a long time need for a concise book on the skin diseases of the dog and cat in this country, to which ready reference may be made by the practising veterinary surgeon.

Veterinary dermatology is a branch of veterinary science which has received but little attention by the profession, so much so, that there is no satisfactory reference work on the subject applicable to the dog and cat in Great Britain. That the B.V.A. has produced a handbook which brings together in some 72 pages the clinical aspects of the major skin diseases of these 2 species, is in itself, a matter for congratulation.

The booklet is not a textbook but rather a guide and, as such, is set out in an easily readable style. It is practical without being academic in its treatment of the subject.

The sections dealing with the anatomy and histology of the skin, nutrition in its relation to skin disease, and the one on skin tumours are adequate, the latter well illustrated. A reduction in the number of photographs of skin neoplasia and the inclusion of illustrations of other skin conditions would have led to greater balance in this section.

The parasitic, fungal, bacterial, hormonal and non-specific conditions are not so well covered as those associated with neoplasia.

One is pleased to see that mention is made of conformation in relation to the aetiology of skin disease at a time when selective breeding of many pedigree animals is, in general, tending to increase rather than reduce the incidence of congenital abnormalities.

Practical methods of diagnosing parasitic and fungal disease are described in detail, although one would hesitate to agree that direct microscopic examination of skin scrapings for mange mites is the method of choice, as one may too readily arrive at a negative diagnosis; or that the use of a solution of potassium hydroxide stronger than 5 per cent. when preparing such material would be advisable as it causes fragmentation of the parasites and increases the difficulty of identification.

In the section on Dermatomycosis there is some inconsistency in terminology. It is also unfortunate that the table of vitamins, Table II, has been placed in the text of parasitic diseases of the skin.

One looked for greater detail on the more recent treatments available but realised that, in a booklet of this nature, space restricts the scope of those compiling it.

This publication is not perfect, those who compiled it would be the more surprised if it were so. It is to be hoped that those who read it will find it of practical value and be stimulated to pay greater attention to individual cases of skin disease with which they are confronted, and also to record and publish their observations to the general benefit of the profession.

Normally reviews of publications appear in our Current Literature section, but it was felt that the attention of members would more likely be caught if this particular review was published as a news item. —EDITOR.

FOOT-AND-MOUTH DISEASE

In the House of Lords last week Lord Bossom asked whether any information was available as to the method of inoculating cattle against foot-and-mouth disease which was being successfully used in parts of South America; and if not whether it could be technically investigated to ascertain if it could be used with equal success in Great Britain.

In reply Lord Waldegrave, Joint Parliamentary Secretary to the Ministry of Agriculture said:—

"I hope I may be permitted to answer this important question in some detail. Vaccination against foot-and-mouth disease has long been practised in South America and also in other parts of the world where the disease is endemic, or enzootic, and widespread. Information about the methods used was given in Chapter III of the Report of the Departmental Committee on Foot-and-Mouth Disease published in 1954 (the Gowers Committee).

"My right hon. Friend, the Minister, is familiar with the situation in the South American countries. Indeed, 3 of our veterinary officers are permanently stationed there to assist the authorities in dealing with foot-and-mouth disease, particularly in the context of the fulfilment of the Bledisloe Agreement, which regulates the transit and inspection of animals and carcases intended for export to this country. Recently, new measures have been introduced in the Argentine, and we welcome these further steps towards the ultimate goal of eradication.

"Vaccination against foot-and-mouth disease is *only* sound policy where there is so much of it that compulsory slaughter is impracticable. In our own country, we are fortunate that the disease is *not* always with us. When an outbreak does occur in this country, by far the most effective way of dealing

with it is to stamp it out by the compulsory slaughter of infected animals and dangerous contacts.

"Finally, the European Commission for the Control of Foot-and-Mouth Disease, to which we belong, has recommended that those member countries which are not yet in a position to use compulsory slaughter should seek, by vaccination and other control measures, to reduce the incidence of the disease to the point where a slaughter policy becomes practicable. Nobody doubts the wisdom of this policy objective, which other countries, less fortunate than our own, are striving to attain."

"FINDING THE LEAN"

An ingenious method of assessing the amount of lean meat in a pig's carcase is being tried out by the Pig Industry Development Authority.

Every week the Authority weighs about 40 pigs in the usual way and then in water at the National Pig Progeny Testing Station at Letchworth. By using the principle Achimedes discovered in his bath over 2,000 years ago and comparing the two weights the density of the carcase is found. As a pig's fat is less dense than its bone or lean, and as all pigs reach a stage when the growth of bone and lean is insignificant, compared with the growth of fat, it is possible to calculate the amount of fat. Afterwards the carcases are dissected and the estimated amount of lean is compared with the actual amount. Early reports on the project are encouraging.

Experiments started at the Hillsborough Research Institute in Northern Ireland in December, 1958. PIDA made a grant to help the work and a PIDA post-graduate scholar has been engaged on it for five months.

AGRICULTURAL RETURNS FOR ENGLAND AND WALES, DECEMBER, 1960

The results of the December, 1960, agricultural returns for England and Wales showed an increase in the number of cows but fewer heifers and calves as compared with December, 1959. The increase in the pig breeding herd continued, but at a slower rate than in the 2 preceding quarters. There was a decrease in the number of laying fowls, although young fowls both for breeding and egg laying and fowls for the table increased.

Compared with December, 1959, the breeding herd of cattle (the total of beef-type and dairy-type cows) was up by 89,000 (2.8 per cent.) but there were 16,900 (3.3 per cent.) fewer heifers in calf (first calf). There were 78,000 (3.8 per cent.) fewer calves under one year old on farms than a year before.

The total number of ewes and ewe lambs mated in 1960 was about the same as in 1959.

The total breeding herd of pigs (sows and gilts in pig and other sows for breeding) was 41,000 (7.7 per cent.) more than in December, 1959.

There were about 3 million (6.7 per cent.) fewer fowls of 6 months old and over than a year ago.

Of the fowls under 6 months old, there were nearly 1½ million (14.5 per cent.) more young birds for breeding or egg laying than in December, 1959. The number of broilers raised on agricultural holdings over one acre showed an increase of 6 million (60 per cent.) compared with December, 1959, and other fowls for the table also increased, by over ½ million (18 per cent.).

On December 2nd there were 330,000 (43 per cent.) more ducks on farms than a year before and about 240,000 (8.6 per cent.) more turkeys.

THE FREEDOM FROM HUNGER CAMPAIGN

Lord De La Warr has agreed to be the chairman of the National Freedom From Hunger Committee. The Government is making a contribution of £30,000 to the Campaign's Trust Fund which is additional to the £20,000 already given by the Government towards FAO's campaign costs.

The Freedom From Hunger Campaign was launched by Food and Agriculture Organisation of the United Nations on July 1st, 1960. The objective of this Campaign is an intensification of FAO's normal activities in order to focus world-wide attention on the problems of hunger and malnutrition in countries with rapidly increasing populations. It is to last from 1960 to 1965, and research projects are included in the programme.

CLASSIFIED ADVERTISEMENT RATES

At its January meeting, Council approved a recommendation from the Editorial Committee that rates for classified advertisements in THE VETERINARY RECORD should be increased moderately. The clerical work involved in these advertisements is quite out of proportion to the income, and even the new rates will be considerably lower for our members than those in comparable journals. A revised chart, based on that which appears on advertisement page XXXI of this issue will be published on February 25th, as the new rates will operate from our issue of March 4th.

THE ASSOCIATION OF VETERINARY STUDENTS

The Executive Committee for 1961-62 is as follows:—

President: P. L. Bardgett (Liverpool); Vice-President: J. O. Jarrett (Glasgow); Hon. Secretary: A. J. M. Garland (Glasgow); Hon. Treasurer: J. C. Clark (Glasgow); and Editor: D. O. Drew (Glasgow). Communications to Mr. Bardgett should be addressed to him at the University of Liverpool Veterinary School; those to any of the other Officers to them at Association of Veterinary Students, University of Glasgow Veterinary Hospital, Bearsden Road, Bearsden, Glasgow.

A NEW ANIMAL HEALTH TRUST FILM

Through the generosity of Lord Rank the new film "Veterinary Science and the Farmer" has just been made and illustrates some of the facets of the work of the Trust's Farm Livestock Research Centre at Stock. It is intended for showing to audiences of farmers and others interested in the application of veterinary research to the problems of practical agriculture. The film, which is narrative in style, has an introduction

by the President of the National Farmers' Union, in which he commends the work of the Trust to his members. Applications for the use of the film should be made to the Animal Health Trust, 14 Ashley Place, Westminster, S.W.1.

THE REGISTER OF VETERINARY SURGEONS

Following a Congregation for the Conferment of Degrees held on January 23rd, the undermentioned graduates were admitted to membership of the Royal College of Veterinary Surgeons:—

George, D. B. L.; Gregory, M.; Westcott, Miss M.; and Whittard, L. M.

R.C.V.S OBITUARY

We record with regret the death of the following members of the profession:—

GREY, Gerald Omar Rushie, B.SC., "Sharette," Constant Spring, Jamaica, B.W.I. Graduated July 10th, 1913, at the Royal Veterinary College, London. Died December 11th, 1960.

MACINTYRE, Archibald Bruce, of 19 Ashmere Avenue, Beckenham, Kent. Graduated at the Royal Veterinary College, London, July 13th, 1928. Died February 5th, 1961.

PERSONAL

Dr. F. R. Bell, a senior lecturer at the Royal Veterinary College, has just been named Reader in Veterinary Physiology of the University of London.

Mr. Aubrey E. Ward who was Mayor of Slough, Bucks, from 1940 to 1945, is to be offered Honorary Freedom of the Borough in recognition of his "eminent, faithful and devoted service" to the town during his 26 years' service as a member of the Council.

Marriage

CROCKETT—CRAIGIE.—On Saturday, December 31st, 1960, at All Saints Church, Kampala, Uganda, Malcolm Ross Crockett, of Bath, Somerset, to Elisabeth Cynthia Craigie, B.V.M.S., M.R.C.V.S., of Bracknell, Berkshire.

Births

CURTIS.—On February 5th, 1961, to Marian, wife of Peter Curtis, a son.

FULLER.—On January 25th, 1961, to Anne (*née* Knowles) wife of A. T. Fuller B.SC., M.R.C.V.S., at Lauriston New Road, Brixham, a daughter, Rachel Lucy, sister for Caroline, John and Crispin.

GRAY.—On January 21st, 1961, to Ann, wife of John Gray, B.SC., M.R.C.V.S., of Aylesbury, Buckinghamshire, a daughter, sister for Jan, Simon and Matthew.

PARKER.—At Cresswell Maternity Hospital, Dumfries, on January 23rd, 1961, to Audrey, wife of William G. C. Parker, B.V.M.S., M.R.C.V.S., 101 St. Marys Street, Kirkudbright, a daughter, Gillian Mary.

COMING EVENTS

February

14th (Tues.). NORTH OF ENGLAND VETERINARY MEDICAL ASSOCIATION CLINICAL CLUB. Meeting at Gosforth Park Hotel, 7.30 p.m.

15th (Wed.). SOUTH EASTERN VETERINARY ASSOCIATION. Annual General Meeting at the Royal Star Hotel, Maidstone, 7.30 p.m.

WARWICKSHIRE VETERINARY CLUB. Meeting in the Regent Hotel, Leamington Spa, 7.30 p.m.

16th (Thurs.). HERTS. AND BEDS. VETERINARY SOCIETY. Meeting at the Sun Hotel, Hitchin, 7.30 p.m.

22nd (Wed.). SUSSEX VETERINARY SOCIETY. Joint Meeting with the local Division of the B.M.A. preceded by dinner at 7 p.m.

EASTERN COUNTIES VETERINARY SOCIETY. Winter Meeting at the Bell Hotel, Norwich, 11.15 a.m.

CAMBRIDGE UNIVERSITY VETERINARY SOCIETY. 2nd Keith Entwistle Memorial Lecture in the Lecture Rooms, Mill Lane, Cambridge, 8.15 p.m. Speaker: Mr. T. Holmes Sellors, D.M., M.CH., F.R.C.S.

SCOTTISH BRANCH. Meeting at Glasgow University Veterinary Hospital, Bearsden, Glasgow, 2.30 p.m.

SUSSEX VETERINARY SOCIETY. Annual Joint Meeting with the Brighton and Mid-Sussex Division of the B.M.A. at the Dudley Hotel, Hove, 8.30 p.m.

SOCIETY OF PRACTISING VETERINARY SURGEONS. Joint Meeting with the Southern Counties Veterinary Society at the Red Lion Hotel, Milford Street, Salisbury, Wilts., 7.30 p.m.

23rd (Thurs.). MIDLAND COUNTIES VETERINARY ASSOCIATION. Meeting at the Feathers Hotel, Bull Ring, Ludlow, Salop, 2.30 p.m.

24th (Fri.). LIVERPOOL UNIVERSITY VETERINARY SOCIETY. Annual Ball in the Students' Union, Bedford Street, Liverpool, 8 p.m.

ASSOCIATION OF VETERINARY TEACHERS AND RESEARCH WORKERS (SOUTHERN REGION). 12th Annual General Meeting at the Royal Veterinary College, Royal College Street, Camden Town, London, N.W.1, 2.15 p.m.

27th (Mon.). EAST YORKSHIRE CLINICAL CLUB. Meeting at the Talbot Hotel, Malton, 8 p.m.

March

1st (Wed.). LANCASHIRE VETERINARY ASSOCIATION. Annual General Meeting at the Department of Veterinary Pathology, University of Liverpool, 2.30 p.m.

B.V.A. TECHNICAL DEVELOPMENT COMMITTEE. Meeting at 7 Mansfield Street, London, W.1, 10.30 a.m.

8th (Wed.). ASSOCIATION OF VETERINARY TEACHERS AND RESEARCH WORKERS, NORTHERN REGION. Annual General Meeting at the Department of Veterinary Pathology, University of Liverpool, 2 p.m.

9th (Thurs.). V.V.B.F. NORTH OF SCOTLAND DIVISION. Annual Dinner and Dance in the Northern Hotel, Aberdeen, 7.30 p.m.

10th (Fri.). GLASGOW UNIVERSITY VETERINARY MEDICAL ASSOCIATION. Annual Ball in the St. Enochs Hotel, 8 p.m.

15th (Wed.). R.A.V.C. DIVISION. Meeting at the R.A.V.C. School and Stores, Thornhill, Aldershot, 11 a.m.

18th (Sat.). B.S.A.V.A. NORTH WESTERN REGION. Meeting at the Exchange Hotel, Liverpool, 7.30 p.m.

ADDRESSES OF DISEASE INFECTED PREMISES

The list given below indicates, first the county in which are situated the premises on which disease has been confirmed, followed by the postal address and date of outbreak.

Anthrax

Angus. Nether Careston, Brechin.
Cumbs. Scale Houses, Renwick, Penrith (Jan. 30); Howrigg, Blencarn, Penrith (Jan. 31).
Hants. Upham Farm, Upham, Southampton (Feb. 3).
Lanarks. Tanhill Farm, Stonehouse (Feb. 2).
Sussex. Bowders Farm, Balcombe, Hayward Heath (Jan. 30).

Foot-and-Mouth Disease

Hunts. Station Farm, R.A.F. Wyton (Jan. 31).

Fowl Pest

Beds. Albion House, Albion Street, Pitstone, Leighton Buzzard; The Orchard, Albion Road, Pitstone (Feb. 2); Old Farm, Pitstone, Leighton Buzzard (Feb. 4).
Bucks. Barton Grounds Farm, Newton Purcell (Jan. 30); Wendover Road, Stoke Mandeville, Aylesbury; Brook End, Weston Turville, Aylesbury (Feb. 3).
Hereford. Rhyddwr Farm, Staunton-on-Wye, Hereford; White House, Staunton-on-Wye (Jan. 31); Bliss House, Staunton-on-Wye (Feb. 1); New Inn, Staunton-on-Wye; Bliss Hall, Staunton-on-Wye (Feb. 3).
Hants. Homefields Farm, Gally Hill Road, Crookham, Aldershot (Feb. 1).
Lancs. Whitehouse, Salwick, Preston; Carr House Farm, Inskip, Preston (Feb. 1); Swill Brook Lodge, Bartle, Preston (Feb. 3).
Lincs. Bridge Farm, Kirton Holme, Boston (Feb. 4).
Norfolk. The Street, St. Faiths, Horsford, Norwich; Ivy House, Hevingham, Norwich; Heath Farm, Hevingham, Norwich (Jan. 31); 9 Pound Lane, Aylsham, Norwich; Mill Road, Hempnall, Norwich (Feb. 1); Chestnut House, Holt Road, Horsford, Norwich (Feb. 2); Felthorpe, Norwich; White House Farm, Sutton, Norwich (Feb. 3); Bellevue, Horsham St. Faiths, Norwich; Easton Lodge Farm, Easton, Norwich; Ridgemount, Horsford, Norwich (Feb. 4); Stratton Hall, Stratton Strawless, Norwich; Gobble Acre Farm, Hevingham, Norwich; Garfield Poultry Farm, Fakenham Road, Taverham, Norwich; 53 Ivy Road, Spixworth, Norwich (Feb. 5); Silver Dawn, Shorthorn Road, Stratton Strawless, Norwich; The Limes, Trunch, North Walsham (Feb. 6).
Suffolk. Tudorland, Raydon Smear, Southwold (Feb. 2).
Sussex. Haybourn, Pulborough (Feb. 3).
Yorks. Brigg Mount and Kildwick Field, Crosshills, Keighley (Jan. 31).

Swine Fever

Ches. Poplars Farm, Hack Green, Nantwich (Feb. 6).
Devon. Little Thriverton, West Putford; Holsworthy (Jan. 30).
Dorset. Pear Tree Cottage, Elmhurst Road, West Moors, Wimborne (Jan. 30).
Durham. Nunnery Lane Buildings, Nunnery Lane, Darlington (Feb. 3); Nabbs Head Piggery, Green Lane, Durham City (Feb. 6).
Glam. Penrhiwgoch Cottage, Baglan, Port Talbot (Jan. 31).
Glos. Sydenham Farm (rear of Butlers Stores), Blakeney, Glos. (Jan. 30).
Hants. Maccleshill Home Farm, Broadway Lane, Throop, Bournemouth (Jan. 31); Maccleshill Lane Farm, Throop, Bournemouth (Feb. 1).
Lincs. Elmhurst Road, Horncastle (Jan. 31); Manor House, Castlethorpe, Brigg (Feb. 6).
Norfolk. Lacons Corner, Mautby, Great Yarmouth; Dairy Farm, Hardley, Loddon, Norwich; North Farm, Barnham, Thetford (Jan. 30).
Notts. The Hollies, Winthorpe Road, Newark (Jan. 31).
Staffs. Slade Farm, Etching Hill, Rugeley (Feb. 1); 152 Hill Street, Hednesford (Feb. 2); Bagnalls Farm, Alrewas, Burton-on-Trent (Feb. 3); Shrubbery Farm, Daniels Lane, Aldridge, Walsall; Lynn Lane House, Lynn Lane, Shenstone, Lichfield (Feb. 6).
Suffolk. Lower Green Farm, Sotterley, Beccles (Jan. 31); Town Farm, Walsham-le-Willows, Bury St. Edmunds (Feb. 3).
Wilts. Mount Sorrell Farm, Broad Chalke, Salisbury (Jan. 30).
Worcs. The Elms Farm, Netherton, Elmley Castle, Pershore (Jan. 30).
Yorks. Braithwaite Farm, Everingham (Jan. 30); Weighton Road, Skidby, Hull (Jan. 31); Ivy Croft, Appleton-Wiske, Northallerton (Feb. 1); Piggeries, 24 Station Road, Epworth, Doncaster (Feb. 2); Rose Garth, Flaxton (Feb. 3); Cliffe Farm, Stainland, Halifax (Feb. 6).

MR. A. B. MacINTYRE

Mr. J. K. Bateman writes:—

In the passing of Archie MacIntyre, the profession has lost one of its most esteemed members, and one who probably had more friends in the profession than anyone else. Having quietly and efficiently worked on all the veterinary projects of the Wellcome Research Laboratories since he joined them in 1932, he came to have an encyclopaedic knowledge of his subject. He freely passed this on to his fellows and never spared himself in his anxiety to help anyone in trouble. The limelight was not for him. He disliked speaking at meetings but his correspondence with members was voluminous and this bears ample testimony to the soundness of his opinions.

Outside his own spheres of bacteriology, virology and vaccines he kept abreast of the times regarding modern drugs—pharmacology held no terrors for Archie.

But perhaps his greatest asset was the tenacity with which he kept his friends. As the writer will testify, no matter how much one might disagree and argue, Archie did not care and would not have his friendship disturbed. In all, a very loyable fellow who will be sadly missed by us all, but more particularly by his grieving widow and son, the latter still at school, who have our deepest sympathy.

HISTORY OF THE OVERSEAS VETERINARY SERVICES

Volume 1 of this History, sponsored by the B.V.A., is now in an advanced stage of preparation, and should be published in the spring. Contributions by eminent veterinary authors will make this an unusually interesting volume and worthy of all the work put into it by the Overseas Committee. The Editor is Mr. Geoffrey West, M.R.C.V.S.

Letters to the Editor

The views expressed in letters addressed to the Editor represent the personal opinions of the writer only and their publication does not imply endorsement by the B.V.A.

Vaccination Against Foot-and-Mouth Disease

Sir,—In your issue of January 7th you published a letter in which Mr. Phillips asked *the* question on the subject of vaccination against foot-and-mouth disease in this country: why should a farmer not be allowed to vaccinate his stock at his own expense if he accepts any restrictions that might be placed on him, even to the point that his animals would be slaughtered if the disease appeared on his farm?

To answer this, it is not necessary to review the whole field of vaccination against foot-and-mouth disease, for the arguments that brought the Gowers Committee to the conclusion in favour of the slaughter policy are still valid, in spite of advances in methods of vaccine preparation and a reduction in cost.

The question rests on the probable result of general permission to vaccinate in this country. It is not unreasonable to assume that a substantial number of herds would be vaccinated, and even 1 per cent. would entail about 100,000 cattle. No matter how excellent a vaccine were used, it would not give complete protection to all animals and, perhaps more important, with the waning of immunity a larger and larger proportion of animals would become susceptible before re-vaccination took place. At the time of outbreaks such as that of November, 1960, all such herds exposed to infection would contain animals liable to react in different degrees to infection. Some would show only mild and unobtrusive lesions. Such animals would be a grave hazard to unvaccinated stock. Their detection would require detailed and frequent inspections. Briefly, if the staff of the Animal Health Division was fully extended in dealing with the 1960 outbreak, how could they be expected to deal with the incomparably greater task of tracking down infected animals of this kind?

Yours faithfully,
J. B. BROOKSBY.

Research Institute,
Animal Virus Diseases,
Pirbright,
Surrey.
February 6th, 1961.

Funds from the Betting Levy

Sir,—The Betting Levy Bill, which has been debated recently in the House of Commons will, I am sure, be of great importance to what remains of the equine side of the veterinary profession, as well as to others concerned in a multitude of ways with horses.

There will be a rather substantial sum of money to be distributed and it is stated in the Bill (Clause 1 l, b.) that part of the annual levy upon bookmakers should be used for "the advancement or encouragement of veterinary science or education."

Mr. Renton (Under-Secretary to the Home Office) said during the Committee stage in the House that "if the organisations concerned with veterinary science wish to obtain grants from the Levy Board their proper course, as for other beneficiaries, will be to make representations to that effect to the Board."

It is not clear what organisations are permitted to apply for help, or even if representation may come only from professional bodies such as the B.V.A. or the R.C.V.S.

If, as seems likely, some sum of money is, in fact, granted by the Levy Board to the profession, how will it be distributed and by whom is it going to be used? Of course, one presumes that many people representing worthy causes will have their case put powerfully through various channels; and this being so I am surprised that, so far, no veterinary surgeon or official body representing us has seen fit to air views in THE RECORD.

It seems to me that someone must start the ball rolling, and at the risk of speaking prematurely I should like to place some personal opinions before you.

(a) The money should be devoted to furthering knowledge of problems concerning the horse.

(b) It is of great importance that there should be an equitable distribution of the grant between those institutions and people interested and able to pursue research in this species. As an example, I was most surprised to read in *Hansard* that out of a grant of £20,700, only £400 had been granted by the Totalisator Charity Trust to the veterinary school at the University of Cambridge, and none to any other university or school.

(c) It will be necessary not only to analyse carefully the manner in which recipients of money use it but to encourage at least a few more young members of the profession to join in equine research over a wide field. One has only to talk to the members of any year at a college to realise quickly that the great majority regard the horse as an anachronism. Certainly it may be, to a large extent, but not so far as the Thoroughbred is concerned in this country: abroad we are still considered to be the leading breeders of bloodstock. Furthermore, there are many important aspects of comparative pathology and physiology which are well worth pursuing. One has only to think of neonatal conditions, haematology and even neurology as important examples.

(d) Clinical research, too, in all its aspects, is deserving of attention. Moreover, there must be a close and serious liaison between the laboratory

worker and clinician. I feel that it is important to realise that clinical research depends for the most part on the opportunity of studying fairly large numbers of horses in the field. This opportunity is available only to a relatively few practitioners. Essential though specialist facilities and the universities or other organisations are, it is from the field that the important material or data is always drawn. This is especially so with *Equidae* because institutions are unable to breed large numbers of horses, as they can the smaller farm and laboratory animals.

I believe, therefore, that since the horse is in a unique position we must be very careful how we use any money coming to us for research.

I think it would be a worthwhile idea to set up fellowships both for newly qualified members and for those of some seniority who are specially interested in the horse. Supervised by university or other research organisations these fellowships could be used to enable research workers to observe the various problems in the field. Extended further it would enable expensive equipment which might be beyond the ordinary practitioner's pocket to be loaned for the purpose of recording valuable data.

Fellowships should also be available to practitioners to give them the opportunity to study new techniques at various centres of learning both in this country and abroad. This would encourage them to co-operate in clinical research and make them more fitted to do so.

I make a plea for co-operation between equine practitioners and the institutions to avoid duplication of effort. Finally, I repeat that whatever money may be forthcoming from the Levy Board should be distributed equitably and used wisely in equine research.

Yours faithfully,
P. D. ROSSDALE.

Romney House,
Dullingham Road,
Newmarket.
January 26th, 1961.

The Future of Animal Husbandry in Overseas Territories

Sir,—I have read with great interest the article recently written by Mr. Miller on this subject.

The problems of animal husbandry overseas and elsewhere, perhaps particularly in Africa, are among the most interesting and challenging to this profession. I do feel that some of the present frustrations may well have roots in past decisions. I wonder if it is generally realised that a subcommittee of the Colonial Office considered these problems and arrived at conclusions which, to my personal knowledge, were still in force in the mid-fifties? These conclusions, written from memory, were roughly as follows:—

In under-developed countries veterinary services were to be responsible for animal husbandry in all its aspects; but when those countries had reached a fuller stage of development the veterinary services were to be responsible only for disease control problems.

Perhaps such decisions are related to finance. Nevertheless I am sure it is felt by many, both here and abroad, that such decisions cause acute frustrations in these services where full use of our training is not used, or even recognised. Surely it is time that we, as a profession, got some of these ideas reversed?

One wonders what is the reason for all this. Are the schools doing enough to stress the full importance of animal husbandry at our universities, is it just that most veterinary surgeons have neither the time nor the inclination after a day's work to assist in formulating ideas and policies in the animal husbandry field, or is it just that we do not take our opportunities? I suspect it is the latter.

Yours faithfully,
R. M. S. NEAVE.

Glasgow House,
5 Chapel Street,
Colchester.
January 31st, 1961.

Sir,—To mark United Nations Day, would it be possible to bring out an October number of THE VETERINARY RECORD as a Food and Agriculture Organisation of the United Nations issue?

FAO Officials in Rome might have taken up, by this time, the points raised by Mr. Wm. C. Miller in his article in THE VETERINARY RECORD of January 7th, 1961.

Governments of overseas territories have the FAO Establishment for guidance. Staff experienced in making the desert bloom for livestock can hardly be trained in this country, but rather in areas such as the Ninety-mile Desert in South Australia and the pumice country of New Zealand.

Yours faithfully,
A. W. HART.

c/o 16, South Street,
Dorchester,
Dorset.
February 4th, 1961.

Haemaglobinuria from Excessive Water Drinking

Sir,—I have recently encountered haemaglobinuria in calves due to excessive water drinking. It seems that the last record of this condition in British veterinary literature dates back to 1936, but I feel sure that the phenomenon must be more common than the rare references would suggest.

A batch of 9, 3- to 4-month-old, mixed breed beef calves were given access to an unlimited supply of drinking water for the first time in their lives. Eight hours later 3 of them were found blown and scouring. One died shortly afterwards. It was noticed that all but one of the calves were passing deep port wine-coloured urine. Although a trifle depressed and lethargic, only the 2 blown calves refused to eat nuts when offered. No treatment was given for the haemaglobinuria, and in all the cases the urine appeared to be normal 48 hours after the excessive water intake.

Haemaglobinuria was confirmed by the Veterinary Investigation Laboratory at Liverpool.

The treatment suggested in the literature for this type of haemaglobinuria is common salt by mouth. Common salt was given to the 2 surviving blown calves as part of the treatment for rumenal tympany. It was noticed that these 2 calves were not amongst the first to pass unstained urine.

No subsequent ill effects have been observed in any of the affected animals.

Yours faithfully,
M. A. WRIGHT.

38, Cumberland Street,
Macclesfield.
January 30th, 1961.

Ryegrass Staggers

Sir,—In view of the recent report on "Ryegrass Staggers" (Clegg and Watson, 1960), it was felt that the following account of a similar outbreak seen in North Dorset last summer might be of interest.

The animals affected were in a batch of 120 Suffolk x Grey Faced lambs, 3 months old, running with their dams which had been purchased in the North of England the previous year. The ewes had lambed down elsewhere and in May were brought to the pasture on which symptoms occurred. On June 27th, it was found that 12 lambs had developed nervous symptoms after they had been grazing the fields for a period of nearly 6 weeks. The pasture herbage in one of the fields consisted chiefly of perennial ryegrass, meadow barley and clovers, while in another the predominating species were perennial ryegrass, timothy, meadow fescue, rough stalked meadow grass and white clover. There was no evidence of ergot infection in the ryegrass, but one would not have expected to see it so early in the season. Both pastures were on a clay soil and had not received any fertilisers during the last few years. Water was available in some fields, but in the field where they had been held for the 5 or 6 days before symptoms appeared, the lambs may have been unable to reach it, as the cattle trough had high sides. However, the disease did not occur in lambs on these fields during the dry season of 1959.

At the time of the outbreak some lambs had a greenish diarrhoea, but all were in fairly good condition. None of the ewes was affected. On approaching the flock it was found that 6 lambs were unable to rise, and 6 others became inco-ordinate when hurried. In some the hind legs appeared stiff, and they walked and trotted with a high stepping action, their docked tails held upwards and forwards. Some staggered and fell struggling, and then, after resting awhile undisturbed, attempted to rise, sometimes successfully, only to fall again. There were no deaths, but one of the affected lambs received at the laboratory was *in extremis*. This lamb had diarrhoea, a normal temperature, was recumbent but showed hyperaesthesia and opisthotonus when on its side. Faecal egg counts of the others revealed that several lambs had a light strongyle infestation and in one examined *post mortem*, 5,000 *Nematodirus filicollis* and 5,000 *N. battus* were found. No other significant lesions were observed in the carcase or in sections of the central nervous system, and cultural and biological tests gave negative results. No chemical analysis was undertaken.

Analysis of the pasture herbage showed that the level of cobalt was normal in one of the fields sampled (0.25 p.p.m. on the dry matter), but an extremely low value of 0.04 p.p.m. was found for an adjacent field. Further analyses of the herbage dry matter showed that the copper content was normal (values of 10 and 11 p.p.m. being obtained) and the level of inorganic sulphate was within the range found for pastures in Britain—the results being 0.63 and 0.59 per cent. Molybdenum values were, however, moderately high—13 p.p.m. in both samples—which was somewhat surprising since the soil in the area is Kimmeridge clay.

It was felt that the amount of molybdenum present, in conjunction with the level of inorganic sulphate, might have been sufficient to interfere with the storage of copper in the liver and low liver copper values might be expected in view of Cunningham's findings (1955). Four of the worst-affected lambs were butchered and copper determinations were carried out on their livers. The values obtained were—21 p.p.m., 21 p.p.m., 20 p.p.m. and 162 p.p.m. on 100 per cent. dry matter basis, indicating copper deficiency in 3 of the 4 samples.

The clinical symptoms seen in these lambs were similar to those described as being characteristic of "Ryegrass Staggers" in New Zealand by Cunningham and Hartley (1959). They also resembled the condition known as "Migram" which occurs in sheep on Romney Marsh (Chesney, 1953). Furthermore, there were certain similarities between the symptoms seen in these lambs and those recorded by Clegg and Watson (1960). In the cases they investigated, however, blood samples taken from 3 affected lambs were normal with regard to inorganic phosphorus, serum magnesium and calcium, while the blood copper values were also reported to be normal in 4 lambs affected in a later outbreak.

These results do not, of course, throw any light on the cause of "Ryegrass Staggers" but it would be of interest to know whether any mineral deficiencies or excesses have been demonstrated in other outbreaks of this condition.

Yours faithfully,
E. T. DAVIES,
P. E. FARMER (Miss).

Ministry of Agriculture, Fisheries and Food,
South Western Region,
Bristol.
February 3rd, 1961.

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Factors Predisposing to Canine External Otitis

Sir,—I have read Dr. Fraser's article (*Vet. Rec.* **73** 55) on canine external otitis with great interest. It is encouraging that his findings are generally in accord with our own tentative thoughts on the matter, based largely on that often treacherous premise "clinical impressions."

Some years ago the writer carried out a preliminary investigation of the problem, and a pilot survey of the microflora of diseased ears, in conjunction with Mr. H. P. Harding, then of the Liverpool Veterinary Pathology Department. The opinion reached was that a team of workers from several disciplines would be required to progress far in solving this complicated problem, including, besides a clinician, a pathologist and bacteriologist, a histopathologist specialising in comparative dermatology, a biochemist, a physiologist and possibly a cytologist, a geneticist, a physical chemist and an aimal behaviourist. Accordingly, the work was shelved indefinitely.

However, from these initial investigations and subsequent observations of clinical cases some points of interest were noted:—

In addition to the organisms mentioned by Dr. Fraser there were found several ears containing organisms of the actinobacillus type, some unidentified yeasts and an aspergillus species, especially in animals with long histories of treatment with numerous drugs.

With regard to breed proneness at least 3 factors contributed in addition to "flop" versus "prick" ears. They were: the bore and taper of the vertical and horizontal conchal canals; the degree of hirsuteness of these canals, and the thickness, smoothness and type of integument lining them which in turn is relatable to the following skin types:—

Two main skin types emerged, the greasy or seborrhoeic, and the dry scurfy or squamous, which produced characteristic types of otitis, the former culminating in ulcerative and purulent, and the latter in the well recognised productive or verrucose otitis.

Especially in the "sebaceous" type of dog, a graded order of proneness could be found, from the exaggerated flop-eared Spaniels through Retrievers, Setters and Labradors to Dachshunds. With the "dry" type of dog, the gradient is less apparent but Wire-haired Fox Terriers head the list, closely followed by Airedales and then Irish Terriers, Kerry Blues and the smaller British Wire-haired Terriers. Miniature breeds, extreme brachycephalics and long-coated variants of any breed often show added proneness due to excitable temperament, minute canals, or more favourable microclimate due to poorer ventilation. Good show specimens, chosen on account of ears being "set low" to get a good "dome," appear to be more prone to otitis probably due to the occlusion of the canal by the weighty ear flap.

The Poodle is a law unto itself, but tends to the dry squamous skin type although the canal is not so small as that of the Terrier group. It is, nevertheless, much more hairy and this may explain the persistent irritation and interference by the animal with ears which show little else but erythema.

It has been found that a physically active lotion containing iodoform, zinc oxide and boric acid with minimal bacteriostatic activity is at least as effective in healing exudative and early ulcerative conditions, as well as milder types, than any of the antibiotic, biostatic, anaesthetic, anthistaminic or anti-inflammatory creams, lotions, ointments or powders.

In several cases in the Spaniel range of dogs, where an offensive exudate persisted after many types of treatment including resection, biopsy showed an epithelium in parts of a mere one cell thickness, missing where apposition or other friction occurred, and a grossly oedematous underlying loose connective tissue in which were a number of cells of the lymphocyte series and a few or no polymorphs or organisms. This epithelium of low vitality appeared incapable of regeneration and these dogs were, reluctantly, destroyed.

There is probably more misery and chronic ill health among canine and feline animals from the various types of otitis, assailing them in some cases for their entire adult life, than from any other single condition; and after years of accepting this state of affairs as inevitable, it is stimulating to see the problem is being so thoroughly studied by Dr. Fraser.

Yours faithfully,

LESLIE ARNALL.

Veterinary Hospital,
Pembroke Gardens,
Liverpool, 3.
January 29th, 1961.

Turkey "X" Disease and the Labelling of Poultry Foods

Sir,—I have just returned from the 10th Annual Conference of the British Turkey Federation with a copy of an admirable explanatory paper on this disease which was read by Dr. Blount.

I am fascinated by the investigations undertaken to explain the mortality which appears to have occurred in a few months. I read "turkeys were not finding their rations as palatable as usual. In June young turkeys were dying in large numbers; by early July the problem was even more serious; on July 7th nearly 800 out of 1,000 poults, at one farm, died within 10 to 14 days. On other farms mortality varied, was usually very high, often heavy indeed, 50 to 90 per cent. Turkey "X" disease was found to attack growing pheasants and ducklings."

When feeding trials indicated that proprietary feeds might be faulty we read of chemical investigations of suspect feeds for: caustic alkalies, arsenic, antimony, barium, chromium, boron, copper, cyanides, lead, mercury, oxalates, phenols, phosphides, phosphorus, thallium, selenium, tungsten and zinc. Other examinations were made for, (1) Chemical: aldrin, arasan, dieldrin, D.D.T., chlorinated hydrocarbons, free fatty acids, organic chlorine, organo-phosphorus compounds, D.N.P.P., D.N.O.C., sulphaquinoxaline, "Entramin A," strontium 90. For (2) Glycosides: digitalis, helibor, oleander, ouabane, squill, strophanthin and theobromine. For (3) Vegetable matter: castor beans, croton tyglium, datura stramonium, jatropha curcus, toxalbumins, purgative drugs and santonin.

Finally, Dr. Blount suspects the culprit to be cocoa-husk adulteration of Brazilian ground-nut meal although he adds "Coffee meals may also have been involved."

The following statement is made: "Ground-nut meal (peanut meal, earthnut meal) is a common ingredient of animal feeds, including poultry rations.

It is usually incorporated at from 2½ to 18 per cent. levels since it provides useful amounts of potassium and copper, vitamins B_1, riboflavin and nicotinic acid. (I would note here that potassium is well supplied by cereals, the copper may or may not be available and it is certain that the B vitamins exist in the bound form which are not as readily available as those supplied in the free form for a few pence per ton of feed.) It is a comparatively rich source of pantothenic acid and choline, and its 48 per cent. protein supplies more than average amounts of arginine, methionine + cystine and also some lysine."

Without going too far into technical details, the availability of all these nutrients, vitamins and amino acids will depend on the processing of the raw material: simple one stage expeller, hydraulic or continuous, in which high pressures and concomitant high temperatures are reached; three-stage expeller at lowered temperatures; extraction by petrol, trichlorethylene or other solvent and subsequent steaming off of solvent *in vacuo* or under high temperature. Whatever the method of processing, one thing is certain, that as a constituent of turkey starter diets, ground-nut meal as a high protein ingredient is not a very good source of lysine (1.3 per cent. against fish meal 3.7 per cent., meat meal 2.8 per cent., dried skimmed milk 2.8 per cent., soya meal 3.0 per cent., and dried yeast 3.4 per cent.).

"Of the Brazilian ground-nut meal purchased some samples were abnormal in protein content 56 per cent., and fibre 12 per cent., when compared with normal (48/50 per cent. and 8 per cent. respectively)."

Some time ago I asked the British Veterinary Association to press for legislation for the labelling of poultry feeding-stuffs and the registration of "Brands" to a declared formula similar to American practice. I hold, and still hold the view, that it is manifestly unfair to the farmer and more so to the veterinarian called to attend diseased stock, to be kept in ignorance of the diet being fed.

If ever there was a clear case for legislation along these lines it is to be found in this investigation into Turkey "X" Disease for the following reason: if ground-nut meal is permitted to form 18 per cent. of any pre-starter or poult-starter turkey ration I fail to understand how the tenets of good poult nutrition can be satisfied. The basic requirements for Broad Breasted Bronze turkey stock such as I control being, albuminoids 25 to 28 per cent. (preferably 28 per cent.), oil (as residual oil of ingredients) not more than 3 per cent. (because these are highly oxidised and destructive towards vitamins A and E), fibre (by the Weend method of analysis) not more than 4 per cent. (less if bran or other porous fibre is included in the ration), crude protein—productive energy ratio 1:30, lysine 1.3 per cent. (preferably 1.5 per cent.). The figures in parentheses permit a modicum of cereals to be fed.

If one recognises the necessity for whey factor, grass juice factor and animal protein factor as proposed by Dr. Milton Scott at this Conference, and unquestionably his proposals are correct, then there is no place for ground-nut meal in poult rations because these lysine requirements cannot be met, if it be included.

Accordingly, if I had occasion to advise on deaths of poults and discovered that ground-nut meal, from any source, was included in the diet, I should condemn the ration out of hand for I would consider it would not meet what I believe to be the tenets of good poult nutrition.

As matters stand one has to await a lengthy investigation into losses, with much anxiety for client, much controversy about stamina of stock, many contradictory laboratory reports—in all, a great deal of inconvenience for all concerned simply by the inclusion of an ingredient which, under good formulation of diet should not be included at all.

It would be a very simple matter for the veterinarian to examine a labelled bag, note the presence of ground-nut meal and say "I don't think this ration will meet lysine requirements or if it does it will be unbalanced with respect to oil, albs, fibre or protein/production energy ratio—my advice is change to another supplier."

Yours faithfully,
T. BARTON MANN.

Braust,
Weyhill,
Nr. Andover,
Hants.
February 5th, 1961.

Enteric Diseases of Calves

Sir,—Mr. T. Barton Mann in his letter on Enteric Diseases of Calves (*Vet. Rec.* **73**. 21) suggested that "the feeding of vitamin A in esterified forms to the new-born may be contra-indicated." It is true that vitamin A metabolism may be disturbed by many disease conditions, particularly in diseases affecting the intestine, liver and kidneys, and also in infectious and parasitic diseases when the reticulo-endothelial system is under particular strain. The latter is believed to play an important rôle in the deposition and mobilisation of vitamin A in the body. It is also true that the hepatic esterase may not function properly for some days after birth.

It is, however, well known that vitamin A whether it is supplied as the alcohol or as an ester, appears after absorption in the lymph and in the blood only as the ester of natural long-chain fatty acids. Furthermore, virtually all the vitamin A present in cow's milk and colostrum is in the esterified form. Disturbances in the absorption of esterified vitamin A can be expected to take place only if the production of lipase by the pancreas and/or the intestinal mucosa is impaired. Apart from this I know of no experimental evidence which would indicate that new-born animals utilise vitamin A-esters inefficiently.

Yours faithfully,
G. H. CLEMENT.

6B, Hyde Park Mansions,
London, N.W.1.
February 1st, 1961.